West, Jeffrey (AU2857)

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Sent: Wednesday, January 28, 2004 8:55 AM

To: West, Jeffrey (AU2857)

Subject: Serial No. 09/761,921 interview

Page 14 of the latest Office Action states that the invention of Howell is only included to teach the application of an auxiliary/balancing core to the system of Scott and not to incorporate the entire system of Howell into the system of Scott.

The principal issue to be discussed in the interview is how Howell can be combined with Scott in view of Howell's teaching of the use of an auxiliary transformer only by (1) injecting an oscillator driven signal into the load and neutral lines to enhance fault detection, and (2) the addition of yet another winding circuit on both the current transformer and the auxiliary transformer with an adjustable resistor to cancel current flow fluxes. We would particularly like to discuss the method claim 17 and the following possible amendments to the apparatus claim 1:

1. (previously amended) A zone arc fault detection system for detecting series and parallel arcing faults in a defined zone of an electrical circuit supplying electrical power to a load, comprising:
a single pair of substantially identical parallel insulated load conductors, electrically coupled at a first endpoint and a second endpoint, for each zone in which arcing is to be detected thereby defining a series fault detection zone comprising the length of said parallel conductors between end points where the two conductors are electrically coupled together;
a balancing core operatively associated at said second endpoint with said pair of parallel load conductors; and
a current sensor operatively associated at said first endpoint with each said pair of parallel load conductors;
thereby defining a parallel fault detection zone between said current sensor and said balancing core,
wherein said balancing core induces mutually canceling insertion impedances in said pair of parallel load conductors, and said current sensor produces a signal representative of the difference in the current flow in the two conductors.

1. (previously amended) A zone arc fault detection system for detecting series and parallel arcing faults in a defined zone of an electrical circuit supplying electrical power to a load, comprising:
a single pair of substantially identical parallel insulated load conductors for each zone in which arcing is to be detected, thereby defining a detection zone comprising the length of said parallel conductors between a first end point[[s]] and a second endpoint where the two conductors are electrically coupled together;
a balancing core operatively associated at said second endpoint with said pair of parallel load conductors; and
a current sensor operatively associated at said first endpoint with each said pair of parallel load conductors;
wherein said balancing core induces mutually canceling insertion impedances in said pair of parallel load conductors, and said current sensor produces a signal representative of the difference in the current flow in the two conductors.

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FIELD
A term commonly used to describe the stationary (Stator) member of a DC Motor. The field provides the magnetic field with which the mechanically rotating (Armature or Rotor) member interacts.

FIELD WEAKENING
The introduction of resistance in series with the shunt wound field of a DC motor to reduce the voltage and current which weakens the strength of the magnetic field and thereby increases the motor speed.

FLANGE
Mounting endshield with special rabbets and bolt holes for mounting such equipment as pumps and gear boxes to the motor or for overhanging the motor on the driven machine.

FLUX
The magnetic field which is established around an energized conductor or permanent magnet. The field is represented by flux lines creating a flux pattern between opposite poles. The density of the flux lines is a measure of the strength of the magnetic field.

FORM FACTOR
A figure of merit which indicates how much rectified current departs from pure (non-pulsating) DC. A large departure from unity form factor (pure DC, expressed as 1.0) increases the heating effect of the motor and reduces brush life. Mathematically, form factor is the ratio of the root-mean square (rms) value of the current to the average (av) current or I^rms/Iav.

FORM WOUND
A type of coil in which each winding is individually formed and placed into the stator slot. A cross sectional view of the winding would be rectangular. Usually form winding is used on high voltage, 2300 volts and above, and large motors (449T and above). Form winding allows for better insulation on high voltage than does random (mush) winding.

FRACTIONAL-HORSEPOWER MOTOR
A motor usually built in a frame smaller than that having a continuous rating of one horsepower, open construction, at 1700 -1800 rpm. Within NEMA frame sizes FHP encompasses the 42, 48 and 56 frames. (In some cases the motor rating does exceed 1 HP, but the frame size categorizes the motor as a fractional.) The height in inches from the center of the shaft to the bottom of the base can be calculated by dividing the frame size by 16.

FRAME
The supporting structure for the stator parts of an AC motor; in a DC motor the frame usually forms a part of the magnetic coil. The frame also determines mounting dimensions (see frame size).

FRAME SIZE
Refers to a set of physical dimensions of motors as established by NEMA. These dimensions include critical mounting dimensions. 48 and 56 frame motors are considered fractional horsepower sizes even though they can exceed 1 horsepower, 143T to 449T are considered integral horsepower AC motors and 5000 series and above are called large motors. (For definition of letters following frame number, see Suffixes.)

FREQUENCY
The rate at which alternating current makes a complete cycle of reversals. It is expressed in cycles per second. In the U.S. 60 cycles (Hz) is the standard while in other countries 50 Hz (cycles) is more common. The frequency of the AC will affect the speed of a motor (see Speed).

FRONT END OF A MOTOR
The front end of a normal motor is the end opposite the coupling or driving pulley. (NEMA) This is sometimes called the opposite pulley end (O.P.E.) or commutator end (C.E.).

FULL-LOAD CURRENT
The current flowing through the line when the motor is operating at full-load torque and full-load speed with rated frequency and voltage applied to the motor terminals.

FULL-LOAD TORQUE
That torque of a motor necessary to produce its rated horsepower at full-load speed, sometimes referred to as running torque.

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Important Notices

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IDENTIFICATION
In most instances, the following information will help identify a motor:

1. Frame designation (actual frame size in which the motor is built).
2. Horsepower, speed, design and enclosure.
3. Voltage, frequency and number of phases of power supply.
4. Class of insulation and time rating.
5. Application

INDUCTANCE
The characteristic of an electric circuit by which varying current in it produces a varying magnetic field which causes voltages in the same circuit or in a nearby circuit.

INDUCTION MOTOR
An induction motor is an alternating current motor in which the primary winding on one member (usually the stator) is connected to the power source and a secondary winding or a squirrel-cage secondary winding on the other member (usually the rotor) carries the induced current. There is no physical electrical connection to the secondary winding, its current is induced.

INERTIAL LOAD
A load (flywheel, fan, etc.) which tends to cause the motor shaft to continue to rotate after the power has been removed (stored kinetic energy). If this continued rotation cannot be tolerated, some mechanical or electrical braking means must normally be applied . This application may require a special motor due to the energy required to accelerate the inertia. Inertia is measured in either lb.ft.^{2} or OZ.jn.^{2}
Inertia reflected to the shaft of the motor = (Load RPM) ^{2}/Motor RPM

INSULATOR
A material which tends to resist the flow of electric current (paper, glass, etc.) In a motor the insulation serves two basic functions:

1. Separates the various electrical components from one another.
2. It protects itself and the electrical components from attack of contaminants and other destructive forces.

INSULATION SYSTEMS
Five specialized elements are used, which together constitute the motor's INSULATION

SYSTEM. The following are typical in an AC motor:

1. TURN-TO-TURN INSULATION between separate wires in each coil. (Usually enamel on random wound coils of smaller motors - tape on "form wound" coils of larger motors.)
2. PHASE-TO-PHASE INSULATION between adjacent coils in different phase groups. (A separate sheet material on smaller motors - not required on form wound coils because the tape also performs this function.)
3. PHASE-TO-GROUND INSULATION between windings as a whole and the "ground" or metal part of the motor. (A sheet material, such as the liner used in stator slots, provides both di-electric and mechanical protection.)
4. SLOT WEDGE to hold conductors firmly in the slot.
5. IMPREGNATION to bind all the other components together and fill in the air spaces. (A total impregnation, applied in a fluid form and hardened, provides protection against contaminants.

INSULATION CLASS
Since there are various ambient temperature conditions a motor might see and different temperature ranges within which motors run and insulation is sensitive to temperature; motor insulation is classified by the temperature ranges at which it can operate for a sustained period of time.

There are four common classes:

Class	AC Motor DC. Motor W/1.00 S.F. Max. Total Temperature Range (Including Ambient and Temperature 110*f* Hot Spot) Range		DC Motor Total Temperature Range
A	105*f*C	A	110*f* C
B	130*f*C	B	140*f* C
F	155*f*C	F	170*f* C
H	180*f*C	H	195*f* C

When a motor insulation class is labeled on the nameplate the total insulation system is capable of sustained operation at the above temperature.

INTERMITTENT DUTY
A requirement of service that demands operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load and rest; such alternate intervals being definitely specified.

INTERPOLES
An auxiliary set of field poles carrying armature current to reduce the field flux caused by armature reaction in a DC motor.

INVERTER
An electronic device that converts fixed frequency and fixed voltages to variable frequency and voltage. Enables the user to electrically vary the speed of an AC motor.

I^2R
Losses due to current flowing in a conductor caused by resistance (equals the current squared times the resistance.)

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Important Notices

DETAILED ACTION

Priority

1. The applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 120 as follows:

> The second application must be an application for a patent for an invention which is also disclosed in the first application (the parent or provisional application); the disclosure of the invention in the parent application and in the second application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ 2d 1077 (Fed. Cir. 1994). The disclosure of the 09/426,832 application does not provide sufficient support for the instant invention because there is no current sensor operatively associated with a pair of substantially identical parallel insulated load conductors for each zone in which arcing is to be detected.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 2, 9, 13, 14, 17, 18, 25, 29, 30, and 33-40 are rejected under 35

U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,986,860 to Scott in view of U.S. Patent No. 3,857,069 to Howell.

Scott discloses a method and corresponding detection system for detecting series and parallel arcing faults in a defined zone of an electrical circuit supplying electrical power to a load (column 2, lines 60-64) comprising splitting a conductor in each said defined zone into a single pair of substantially identical parallel insulated conductors, thereby defining a detection zone comprising the length of said parallel conductors between terminating end points where the two conductors are electrically coupled together, providing a current sensor (i.e. toroidal transformer current sensor) operatively associated with each said pair of parallel conductors, and configuring and arranging the current sensor such that the current sensor produces a signal representative of a difference in the current flow in the two conductors (column 3, lines 25-40 and Figure 4). Scott also discloses that the current sensor comprises a di/dt (i.e. time derivate of current) air core toroid (column 10, lines 26-29), a figure-8 shaped core (column 9, lines 6-11), or at least a magnetic core, provided with a wound coil, coupled with the conductors in such a way that the currents travel in opposite directions, and therefore it is considered inherent that the magnetic fields will also oppose each other (column 8, lines 35-41).

Scott discloses an arc fault detector, operatively coupled with the current sensors, that produces a signal indicating an arc fault which is supplied as a trip signal to trip a circuit breaker (column 7, lines 23-41), a RC shunt filter to mask the effects on di/dt due to different load power factors (column 10, lines 53-63), and an

over-pressure relay to detect faults to ground (column 12, lines 48-52). Scott also discloses that during differential phase current arc detection the detection zone is defined by a pair of identical parallel insulated conductors that each carry a load current (column 8, lines 23-41).

Scott also discloses, with respect to Figure 4, the aforementioned embodiment comprising two parallel load conductors coupled at either end of the detection zone. With reference to Figure 4, it is considered inherent that each of the parallel conductors will carry substantially half the total phase current during normal operating conditions since the Figure shows splitting the current between the two conductors and Scott discloses that the current differential between the conductors detected by the current sensor is zero under normal conditions (i.e. the split currents are substantially equal) (column 8, lines 41-43). Further, since the phase currents on the two split conductors ("82" and "84") are substantially half the current of the initial load conductor ("86"), it would have been obvious to on having ordinary skill in the art to specify that the split conductors are essentially half the size of the required size of a single load conductor since the diameter of a wire and its maximum current rating have a direct relationship and the modification would have provided the most efficient wire size for the corresponding amount of current carried through the wire.

With respect to claims 2 and 18, Scott teaches many of the features of the claimed invention including a transformer current sensor with a magnetic core but is silent on the permeability of the core. Although not specifically disclosed, it would have been obvious to one having ordianary skill in the art to include a high

permeablitly core because it is well known in the art that to achieve a given inductance without a high permeability core, more and/or larger turns of the coil would be needed and therefore a core with high permeability would have provided a desired inductance using a smaller transformer to meet space constraints.

With respect to claims 36, 37, 39, and 40, the limitations for including the system in an aircraft are considered to be intended use. A recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). In the instant case, the structure of Scott is applicable in an aircraft system since it includes embodiments for detecting line-to-line arc faults as well as detecting arcs generating frequency components from DC to the megahertz range and beyond. Further, in such a use it is considered well-known in the art to use the frame of the plane as a neutral return to eliminate extra weight (See Applicants Admitted Prior Art in the background of the invention (page 7, lines 23-13) and U.S. Patent No. 5,894,393 to Elliott et al. (column 1, lines 21-31)).

As noted above, Scott teaches all the features of the claimed invention except for including a balancing core operatively associated with the pair of parallel load conductors that provide a differential current unbalance by inducing canceling impedances.

Howell teaches a fault interrupter circuit comprising two parallel line and neutral conductors passing though a differential current transformer and a second auxiliary/balancing core (column 4, lines 9-24) wherein the auxiliary/balancing core provides a detectable current unbalance in the presence of a parallel fault by inducing signals (column 3, lines 12-20) that cancel impedances in the parallel conductors (column 3, lines 21-31 and column 8, lines 64-68).

It would have been obvious to one having ordianry skill in the art to modify the invention of Scott to include a balancing core operatively associated with the pair of parallel load conductors that provide a differential current unbalance by inducing canceling impedances, as taught by Howell, because Howell suggests that the combination would have provided fail-safe circuit interruption by producing a fault condition in situations when a de-sensitized fault occurs that would normally not provide the necessary interruption (column 3, lines 21-43).

4. Claims 3 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent No. 3,914,667 to Waldron.

As noted above, the invention of Scott and Howell teaches all the features of the claimed invention except for specifying that the current sensor comprise a Hall effect sensor.

Waldron teaches a sensing and tripping means for protecting a circuit against damage from overload conditions and preventing erroneous circuit breaker tripping operations due to transient conditions which may occur during normal operation

(column 2, lines 5-11) comprising a Hall effect sensor that produces an output voltage directly proportional to the current flow through a conductor generating a magnetic field concentrated by a magnetic core. (column 2, lines 41-53).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include specifying that the current sensor comprise a Hall effect sensor, as taught by Waldron, because, as suggested by Waldron the combination would have provided a means for developing a voltage signal proportional to the current flow which, when in voltage form, can be used to insure that breaker tripping only occurs when a desired condition is met (column 2, lines 5-19).

5. Claims 4-6 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent Application Publication No. 2002/0011832 A1 to Berkcan et al.

As noted above, the invention of Scott and Howell teaches many of the features of the claimed invention including specifying that the current sensor comprise a di/dt air coil toroid or be formed into a figure-8 configuration, but does not teach that the di/dt sensor be of low permeability or that the figure-8 sensor use a Rogowski coil.

Berkcan teaches primary current conductor configurations for a residential electronic meter comprising a current sensor assembly including a sensor coil, an electrostatic shield coil, a toroid core of non-magnetic material, a housing, and a magnetic shield all arranged coaxially about a pair of primary current conductors

(0007 and 0008) wherein the sensing coil is a Rogowski coil and the core is an air core (0024). Berkcan also teaches that an air core, such as the core disclosed by Scott, is one of low permeability (0010).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include specifying that the current sensor use a Rogowski coil, as taught by Berkcan, because, as suggested by Berkcan the combination would have given an isolated current measurement using a coil that does not saturate with high fields and has an excellent bandwidth and linearity (0024).

6. Claims 7 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and Berkcan and further in view of U.S. Patent No. 6,088,205 to Neiger.

As noted above, Scott in combination with and Howell and Berkcan teaches many features of the claimed invention including a RC shunt filter as well as a current sensor that produces a signal proportional to the difference between the time derivatives of the current in two conductors, but does not teach specifying a circuit for integrating and filtering to produce the current signal.

Neiger teaches an arc fault detector with circuit interrupter comprising an AFCI/GFCI circuit including two current transformers consisting of magnetic cores and coils (column 8, lines 61-63) and a toroidal current to voltage transformer (column 9, lines 58-60) wherein the output of the toroidal transformer is input to two

separate circuits, one circuit being high frequency comprising a high pass filter, full wave rectifier, amplifier, and integrator, and the second circuit being the AC line frequency circuit comprising a low pass filter, full wave rectifier, amplifier, and integrator (column 10, lines 22-28).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott, Howell, and Berkcan to include specifying a circuit for integrating and filtering to produce the current signal, as taught by Neiger, because, as suggested by Neiger, the combination would have provided a method for splitting of the output signal from the transformer into two signals of different frequencies to permit the device to react to different combinations of AC line frequency and high frequency arcing signals and therefore permitted the AFCI circuit to react appropriately to many different arcing situations (column 10, lines 26-33) with the integrator generating the necessary signal representative of the level of the average peak arc current present on the AC line (column 12, lines 18-20).

7. Claims 8 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent No. 5,420,504 to Berkcan.

As noted above, the invention of Scott and Howell teaches many of the features of the claimed invention including a RC shunt as well as a current sensor to determine the difference in current between two conductors, but does not teach

measuring the current signal using a current sensor comprising a resistive shunt that produces a voltage difference proportional to the measured current signal.

Berkcan teaches a current measuring system that uses a measurement of voltage for assessing the value of the current (column 2, lines 25-29) comprising a non-inductive current sensor that determines the sensed current using the voltage drop or voltage difference across the resistive shunt between a pair of contact points (column 4, lines 6-11).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include measuring the current signal using a current sensor comprising a resistive shunt that produces a voltage difference proportional to the measured current signal, as taught by Berkcan, because, as suggested by Berkcan, the combination would have provided a sensor that can be used in a three-phase network, or other configuration with more than one sensor employed in close proximity, while reducing or substantially eliminating the mutual coupling effects that may degrade the quality of the sensor current measurements (column 4, lines 20-35).

8. Claims 10-12, 15, 26-28, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Scott in view of Howell and further in view of U.S. Patent No. 5,519,561 to Mrenna et al.

As noted above, the invention of Scott and Howell teaches all the features of the

claimed invention except for a circuit breaker using a bi-metal current sensor and armature that moves (i.e. is attracted) by the magnetic core in response to the current difference.

Mrenna teaches an electrical system protected, by a circuit breaker, that includes a line conductor and a neutral conductor connected to provide power to a load wherein the breaker includes a thermal magnetic overcurrent detector comprising a bimetal connected in series with the line conductor. Mrenna then teaches that persistent overcurrents bend the bi-metal causing it to release a hatch which actuates the trip mechanism as well as that short circuits passing thought the bimetal magnetically attract an armature to release the latch and actuate the trip mechanism (column 3, lines 15-28). Mrenna also teaches an arc detector that sends a trip signal to the breaker in response to the reception of a bandwidth limited di/dt signal a predetermined number of times (column 3, line 62 to column 4, line 2).

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include a circuit breaker using a bi-metal current sensor and armature that moves (i.e. is attracted) by the magnetic core in response to the current difference, as taught by Mrenna, because Mrenna suggests a circuit breaker sensor, applicable as the breaker disclosed in the invention of Scott, that would have produced accurate current measurements inexpensively and without excessive space (column 2, lines 1-19).

9. Claims 16 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Scott in view of Howell and further in view of U.S. Patent No. 5,905,619 to Jha.

As noted above, the invention of Scott and Howell teaches all the features of the claimed invention except for including a relay, responsive to the differential current, coupled to the circuit breaker for its operation.

Jha teaches an arc fault detection system comprising a circuit electrically connected between a power source and a switchboard, a control power source for a differential current relay, a source current transformer coupled to the electrical circuit between a circuit breaker and the switchboard wherein the differential current relay is electrically connected to the breaker such that when the differential current relay determines a differential current it opens the breaker (column 1, lines 45-62)

It would have been obvious to one having ordinary skill in the art to modify the invention of Scott and Howell to include a relay, responsive to the differential current, coupled to a circuit breaker for its operation, as taught by Jha, because, as suggested by Jha, the combination would have provided a current detection system reduces the occurrence of unwanted breaker tripping by only receiving current through the operating coils when an arc fault occurs and not during normal operation (column 1, line 66 to column 2, line 10).

Response to Arguments

10. Applicant's arguments filed 06 October 2003 have been fully considered but they are not persuasive.

Applicant argues the combination of Scott and Howell because "[t]he teachings of Howell are very similar to many present ground-fault-circuit-interrupter circuits. Scott, however, relates to arc fault detectors, not ground–fault detectors. One skilled in the art, therefore, would not make a combination of Scott and Howell."

The Examiner asserts that as long as a prior art reference is either in the field of applicant's endeavor or, if not, is reasonably pertinent to the particular problem with which the applicant was concerned, the reference can properly be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, each of the instant invention, Scott references, and Howell references are concerned with the problem of electrical fault detection.

Further, the Examiner notes that arc-fault detection and ground-fault detection are often used in combination (See for example, U.S. Patent No. 5,889,643 to Elms).

Applicant then argues that "[t]he invention of Howell requires both a neutral ground wire and a load wire coupled with two toroids. . . Without a neutral wire the Howell patent has no application, and thus cannot be combined with Scott, which has no neutral wire. Furthermore, if the Howell method were mistakenly applied to only the line conductor(s) of Scott, as the Examiner suggests, the resulting combination would only sense the connected load impedance-to-frame or a 4 ohm or less line-to-frame fault. This is not useful."

The Examiner maintains that the invention of Howell is only included to teach the application of an auxiliary/balancing core to the system of Scott, not to incorporate the entire system of Howell into the system of Scott. Further, this teaching of Howell has desirability in the invention of Scott because by adding the auxiliary/balancing core of Howell to the existing system of Scott would have provided fail-safe circuit interruption by producing a fault condition in situations when a de-sensitized fault occurs that would normally not provide the necessary interruption (column 3, lines 21-43).

Applicant also argues that "[t]he mere existence of the secondary toroidal core auxiliary transformer 24 in Howell, does not suggest the balancing core of the present invention or its electrical relationship with the pair of load conductors and the current sensor of the present invention." Applicant, however, has failed to sufficiently explain why the toroidal core auxiliary transformer of Howell does not meet the limitation of a balancing core. The Examiner maintains that claims 1 and 35 only require "a balancing core operatively associated with a pair of parallel load conductors" and the combination of Scott and Howell provides splitting a conductor in each said defined zone into a single pair of substantially identical parallel insulated conductors, providing a current sensor (i.e. toroidal transformer current sensor) operatively associated with each said pair of parallel conductors (Scott, column 3, lines 25-40 and Figure 4) and specifying that the detection zone is defined by a pair of identical parallel insulated conductors that each carry a load current

(Scott, column 8, lines 23-41) in combination with two parallel line and neutral conductors passing though a differential current transformer and a second auxiliary/balancing core (Howell, column 4, lines 9-24) wherein the auxiliary/balancing core provides a detectable current unbalance in the presence of a parallel fault by inducing signals (Howell, column 3, lines 12-20) that cancel impedances in the parallel conductors (Howell, column 3, lines 21-31 and column 8, lines 64-68).

Applicant then argues the combination of Waldron with the invention of Scott and Howell because "the combination of a Hall effect sensor with the invention of Howell itself produces an unworkable solution. Such a combination would reduce the effectiveness of the sensing core of Howell and, instead of sensing a 5 ma fault, it might begin to sense at 5 amps. The ground-to-neutral oscillatory circuit would, instead of finding 4 ohms, find perhaps a 0.004 ohm fault. Neither of these results is useful or appropriate in circuit fault detectors. Thus combining the active circuitry as taught by Howell with Scott and Waldron can be seen to have undesirable results."

Similar to the explanation provided above, the Examiner asserts that the invention of Waldron is only included to teach specifying that the current sensor comprise a Hall effect sensor in the system of Scott not to incorporate the entire system of Waldron, including an oscillatory circuit, into the system of Scott.

Applicant also argues the combination of Neiger with the invention of Scott, Howell, and Berkcan because "the circuit of Neiger cannot be combined with that of Scott alone, or Scott and Berkcan, for many of the same reasons as discussed with respect to the operation of the circuit of Howell. The circuit of Neiger also requires sensing of the load and neutral lines and cannot be used to monitor the bifurcated load lines used in Scott."

The Examiner maintains that the invention Neiger is only included to teach a circuit for integrating and filtering to produce the current signal. As shown in Figures 6 and 7 of Neiger, the filtering and integrating circuit only performs operations on the already sensed current outputs from current transformers. This operation is not dependent on the type of lines being monitored, only on the output of the transformers, and would perform the same operation on a line-line system or a line-neutral system. Therefore, the filtering and integrating operations can properly be performed on the output of the current sensor present in the invention of Scott, Howell, and Berkcan.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent No. 5,889,643 to Elms teaches an apparatus for detecting arcing faults and ground faults in multi-wire branch electric power circuits.

U.S. Patent No. 6,633,467 to Macbeth et al. teaches an arc fault current interrupter which detects and interrupts line side arcing.

U.S. Patent No. 6,628,487 to Macbeth teaches a method and apparatus for detecting upstream series arc faults.

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeffrey R. West whose telephone number is (703)308-1309. The examiner can normally be reached on Monday through Friday, 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (703)308-1677. The fax phone

numbers for the organization where this application or proceeding is assigned are (703)308-7382 for regular communications and (703)308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

jrw
January 28, 2004